DRAFT FOR REVIEW: 4-22-15

New Hampshire
The *Resilient* Granite State

A Workbook Guide on
Climate and Health Adaptation
For Regional Public Health Networks

Healthy New Hampshire

Global Climate Change
Implications for Public Health

CDC
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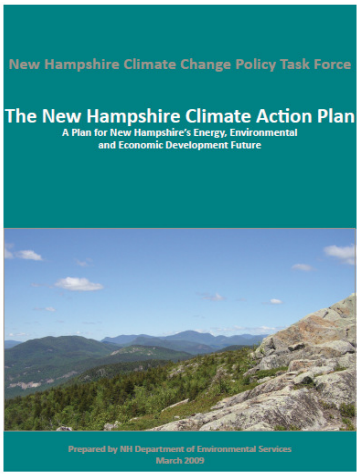
Climate Action in New Hampshire

This climate and health adaptation initiative is an outgrowth of the NH State Climate Action Plan created in 2009. That Plan's adaptation chapter recommended that the public health community identify and protect the vulnerable populations at risk for climate impacts, such as the groups located in high-hazard areas. We can't always predict or prevent the impact of severe weather events or climate-related changes, yet communities can take steps now to prepare and adapt to protect those in need.

To help our communities adapt to the health risks, the 2009 plan recommends:

- Public health and emergency response agencies collaborate with the appropriate agencies and organizations to develop effective public outreach.
- Partnerships between these organizations share relevant data and information.
- Educated and empowered public health officials in New Hampshire to prepare for health-related and social impacts resulting from climate change.



NH Climate Action Plan, 2009.

New Hampshire is in a unique position to address severe weather and climate issues in relation to public health. From a public health perspective, we have a number of important weather and climate-related health risks.

- NH has **one of the highest rates of asthma in the nation**, and
- **Lyme disease has grown faster in NH** than in any other state.

Through the Regional Public Health Networks, we have an opportunity to reduce the impact of severe weather and climate change on our communities, citizens, and visitors.

One of the goals of this guidance workbook is to address the three (3) recommendations above, and assist local public health agencies in collaborating, sharing information, and preparing for the potential health impacts of severe weather and climate change.

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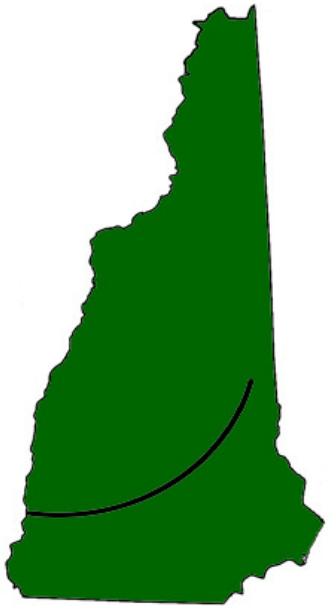
Acknowledgments: This draft publication was produced by a collaboration of partners, including Matthew Cahillane and Neil Twitchell at the New Hampshire Department of Health and Human Services (DHHS), Division of Public Health Services (DPHS), Roger Stevenson, Stacey Smith, and Robin Schell at Stevenson Strategic Communications, and Kathleen Bush at Plymouth State University. Additional edits and improvements are expected to be provided by staff from the NH Regional Public Health Networks.

Funding: This publication was supported by Centers for Disease Control and Prevention (CDC) grant number #5UE1EH001046-03 via the National Center for Environmental Health in Atlanta, Georgia. The contents of the report are solely the responsibility of the authors and do not necessarily represent the official views of the CDC.



Introduction to the Guidance Workbook

The main purpose of this workbook is to assist the Regional Public Health Networks (RPHNs) in creating climate and health adaptation plans that fit local needs, local populations, and build greater community resilience in response to severe weather and climate change.

An adaptation plan is similar to a hazard mitigation plan in that it describes known hazards, prioritizes them, finds solutions, and puts actions into place with measurable results. Climate adaptation plans have a primary focus on short-term solutions to weather-related challenges that we are experiencing now (longer seasons, hotter days, heavier rain events, etc.) and may have a secondary focus on long-term planning related to climate change (like greenhouse gas emissions and deforestation).

A good comprehensive climate adaptation process integrates well into other community health planning efforts. A good climate adaptation plan:

1) Reflects hazards and threats that may be outlined in a municipal hazard mitigation plan, and
2) Includes health issues that may be identified in your Community Health Improvement Plan (CHIP), or a RPHN's hazard vulnerability assessment.

The climate -health adaptation plan can be integrated as a chapter or appendix in an existing plan (e.g. regional public health response plans and/or local emergency operations plans). A number of organizations have begun adaptation planning, and have used a framework called 'Building Resilience Against Climate Effects' (BRACE) as a guide.

This workbook will help you understand, assess, and plan how to adapt to a changing climate and respond to emerging health issues in your community.

The primary benefits of local climate adaptation planning include:

1) Identifying populations at-risk in your area
2) Improving emergency preparedness
3) Preventing injury and illness
4) Saving your community time and money

Due to the wide variation in weather/climate hazards across New Hampshire, local or regional approaches will strengthen a statewide plan. Most towns have hazard mitigation plans that already

identify and address how to deal with local threats and disasters, including storms, floods, and terrorism. A well-designed climate and health adaptation plan should integrate well with existing local plans.
The secondary benefits of regional climate and health adaptation planning include:

1) Raising awareness of climate change issues as a means to preventing injury and illness
2) Improving housing
3) Reducing infectious disease, and
4) Strengthening emergency preparedness

Adaptation planning can also lead to the development of **useful public health resources for the local community** (i.e. web tools, summary statistics, training materials, etc.). Climate and weather adaptation efforts also open up new pathways for funding and collaborative initiatives specific to the region. Although public health funding is often limited, there are many organizations that provide funds to support climate-specific needs assessments, environmental programs and initiatives to promote energy awareness and efficiency.

Other advantages of adaptation planning include the ability to create synergy with existing RPHN goals, such as:

- Identifying new topics of interest, or concern, in the community
- Identifying new members to join the PHN Advisory Council
- Strengthening existing partnerships in the Network, or adding new partners and organizations
- Creating a focal point for health outreach across the seasons, such as summer (heat injury, sun protection, lightning, etc.), autumn (arboviral diseases, beginning of cold/flu season), winter (slips and falls, cold injury) and spring (ticks, pollen, asthma, flooding)

In summary, Climate and Health Adaptation Plans (CAPs):

- ✓ Focus on short-term solutions
- ✓ Integrate well into other community health planning efforts
- ✓ Reflect threats outlined in municipal hazard mitigation plans and regional hazard vulnerability assessments.
- ✓ Blend with the community health improvement plan
- ✓ Can be integrated as a chapter or appendix in an existing plan
- ✓ Benefits the community in a number of ways.

❖ **Your charge is to design a Climate and Health Adaptation Plan that addresses local public health issues, and targets ways the health sector can adapt to severe weather and a changing climate.**

Important Concepts

In order to understand the task at hand, it is important to define some common terminology and build a collective understanding.

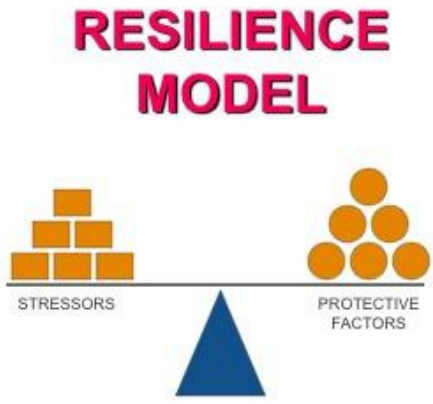
Climate adaptation versus climate mitigation – Adapting to climate change is the ability to reduce the impacts of a warmer, wetter, and unpredictable world. Mitigating climate change is the ability to reduce the *drivers of change*, such as reducing greenhouse gases or maintaining forests to absorb excess carbon dioxide.

Weather versus climate – Weather is a one-time event that might occur today, this week, or this year. Climate is a pattern of weather events that occur over and over again in a consistent or predictable way.

** Further Terms and Acronyms are defined in Appendix A*

What is resilience? The basic idea of community resilience is the capacity to bounce back from stressors or a disaster. In a world where you cannot always predict where or when a disaster will occur, resilience allows a community to strengthen protective factors against hazards and build a community that can better adapt to change. At least four factors influence resilience (Norris, 2010):

1) Access to economic development,
2) Cooperation and social capital,
3) Information or communication, and
4) Competence or decision-making.



Resilience is a careful balance between stressors and protective factors. *Source: Maggie Dent 2011*

Project Goals, Outcomes and Timeline

The final outcome of Climate Health Adaptation Planning is **a community that is more resilient** and able to protect community health in the face of severe weather and a changing climate by:

- Building a more climate resilient health care system, emergency response sector, and other important areas.
- Identifying the most vulnerable people to certain health outcomes, and targeting them during severe weather events or seasonal climate changes (pollen season, tick season, heat season, etc.).
- Building an evidence base to know which strategies work, such as education, outreach, early warning systems, or reducing exposures.
- Having an Action Plan in place to put these solutions into practice, and being able to measure if the actions are effective or not.

The ultimate outcomes of a Climate Health Adaptation Plan can include:

- Improvements to public health by reducing rates of illness and injury, and/or increasing wellness.
- Increasing community resilience through stronger collaborations, emergency preparedness, and decision making based on a local evidence base.
- Better skills to assess community vulnerabilities and strengths via trends that influence regional weather, climate and public health.
- Increased knowledge of weather and climate change.
- A greater awareness of the relationship between severe weather, climate change, greenhouse gases, and public health outcomes.

Provided below are a list of products that you will need to build into each element of the Climate Health Adaptation Plan.

A checklist of products includes:

	✓
1. Document at least three (3) vulnerable populations and three (3) health outcomes relevant to extreme weather and/or climate change. The draft plan can be hard copy or web-based.	
2. A set of strategies (i.e., public health interventions) that address regional weather or climate vulnerabilities.	
3. A list that shows the number of existing local and/or regional hazard vulnerability assessments and mitigation plans reviewed to identify priority health issues related to climate change impacts.	
4. A list of the regional entities participating in the strategic planning process.	
5. A table that identifies and prioritizes health impacts related to climate change; each impact should be linked to populations that are most vulnerable and describe the size and geographic distribution of each vulnerable population.	
6. A summary table that lists the local risks and public health resources identified in local, regional and state hazard mitigation plans; describe the gaps identified in these plans related to emergency preparedness capabilities needed for an optimal response to extreme weather events and changes in climate.	
7. A description of recommended public health strategies to implement in the region that address important gaps and identifies viable interventions to reduce risks from extreme weather events and changes in climate.	
8. A set of measures of community health resilience and adaptation that include better preparedness-response-recovery cycles, increased collaborations, innovative communications, and improved decision-making. Because population-level health outcomes can be difficult to measure, and often take many years to change, we encourage organizations to develop intermediate measures of resilience and vulnerability.	

How to Use This Document

The action steps below will guide you through a process of developing a Climate Health Adaptation Plan:

PLANNING PHASE		
Step 1:	**Read**	Begin the project by getting familiar with this guide, any relevant background information for your communities and region. Gather all of the relevant regional climate information, emergency preparedness documents and public health documents. Share them with network partners to increase access and awareness.
Step 2	**Write**	Outline the process by which you will develop a Climate Health Adaptation Plan. Write a draft including strategy and evaluation measures, activities, outcomes, and a general timeline.
Step 3	**Post**	Create a central web page to store all of your relevant information so you and others can easily access it. (Use existing websites when possible.)
Step 4	**Identify Team & Roles**	Consider the skills you will need to complete the task. You will likely need to focus on project management, research, writing, and meeting facilitation from within your advisory council and other partners.
Step 5	**Engage Partners**	Make a list of community entities and members who care about weather and climate and health. Consider emergency planners, emergency responders, weather reporters, the Red Cross, environmental advocates, and health experts. Schedule your meetings and invite participants. Set a clear agenda with specific outcomes for each meeting.

COMMUNITY ASSESSMENT		
Step 6	**Assess Local Weather & Climate Vulnerabilities**	Read through local hazard mitigation plans, regional climate assessments, and related FEMA flood maps or similar guides. Begin the BRACE framework for building resilience.
Step 7	**Identify At Risk Populations; Assess Health Burdens**	Outline the likely populations at-risk and their health outcomes, linking them to known climate vulnerabilities (heat, storms, flood, etc.).
Step 8	**Assess Interventions That Reduce Health Impacts**	With your list of health vulnerabilities in hand, complete a review of evidence-based practices for addressing them. The best solutions will match your health issue, population and geography.

STRATEGY DEVELOPMENT & MEASUREMENT		
Step 9	**Develop a Plan of Action**	Create a logic model that connects your vulnerability assessment, potential solutions, strategies/interventions, and short or long term outcomes.
Step 10	**Evaluate Progress**	Put a process in place for identifying evaluation measures, setting baseline measures, and tracking your measures over time to show any changes resulting from your work. The NH DHHS will consult with PHNs on how to best evaluate progress in your region.

REPORT PREPARATION & DISTRIBUTION		
Step 11	**Write Draft Document**	Write up the Climate Health Adaptation Plan in a paper document or web site that can be accessed by all involved.
Step 12	**Finalize Report**	Write up a final summary of your actions and results. Make recommendations for how different sectors and members of the region can act (or are acting now) to build climate resilience, reduce vulnerability, or improve health outcomes.
Step 13	**Distribute Report**	Make sure all of your good work makes it to your stakeholders, the media, funders, and anyone else invested in making it a success. Do not let it sit on a shelf.

ACTION & EVALUTION		
Step 14	**Take Action via Outreach**	Collaborate with partners to begin implementing pieces of the plan. Through outreach portions of your plan, and using both one-way communications (newsletters, bulletins, traditional and social media) and 2-way communications (face-to-face meetings, interviews, etc.) engage stakeholders to take on any actions in their sector.
Step 15	**Track Progress**	Put a process in place to track how your baseline measures change over time to show any changes due to your work. Evaluate in all four measurement "buckets" including cognitive changes, affective changes, behavioral changes and structural or system changes.

Action Steps to Take Now:

1. **Identify a person** to read document thoroughly
2. **Create a timeline** and outline next steps
3. **Select a facilitator** to work with the Advisory Council and other partners engaged in this initiative

Phase 1: Environmental Scan: How to Assess the Impact of Weather and Climate Change on Health in Your Region

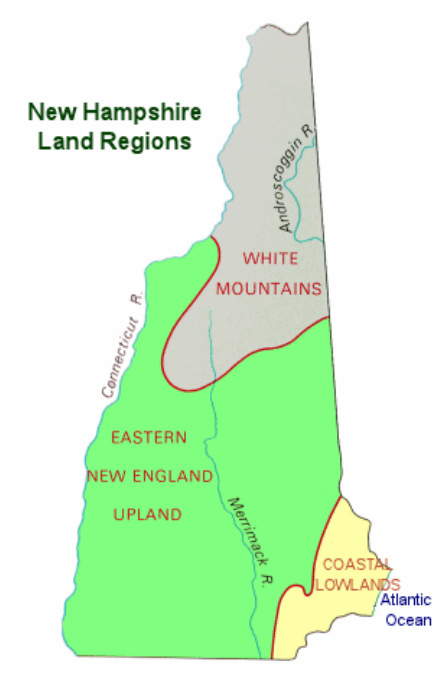
An Environmental Scan serves to greatly expand thinking about the topic at hand and issues in the future. It is a systematic way to broaden the discussion, bring to the table any 'fallout issues' that might divide the group, and recruit others who should participate.

Living in a Changing New Hampshire

If you spend a lot of time outdoors in New Hampshire, or any Northeast State, you may have noticed a change in the weather. Skiers see heavy and light snow years, yet feel that the snow fall is not as predictable as it once was. Farmers and gardeners see longer seasons, and are growing plants that never survived well this far north. Allergy and asthma sufferers often feel that the pollen season has grown longer, or more severe, or they are more reactive to new allergens. The climate has changed, and many outdoor-oriented people notice it first.

Scientists have noticed and studied these changes, too. Long-term research shows that the temperature has been increasing (especially in winter), total annual precipitation has increased (rain, snow, ice) yet is occurring in fewer storm events; and the storms we do get are often more severe.

Figure X. Major Land Regions in NH



The bottom line for your community is that New Hampshire is getting warmer and wetter with more severe weather events. We must adapt to these changes.

New Hampshire Climate

New Hampshire has three major land or climatic regions, including the Coastal Lowlands, the Eastern Uplands, and the White Mountain Forests. Each of these areas has similarities and differences in their weather and climate-related vulnerabilities, health burdens and populations at risk.

Historically, New Hampshire has experienced a humid continental climate, with warm-humid summers, very cold, wet winters, and uniform precipitation levels across the seasons. Average summer daytime temperatures are in the mid-70s°F to low 80s°F in July, with overnight lows in the mid-50s°F to low 60s°F. January temperatures range from an average high of 34 °F on the coast, with overnight lows significantly below 0 °F in the far north and at higher elevations. Average annual precipitation statewide is about 40 inches with variability in the mountains due to elevation and snowfall.

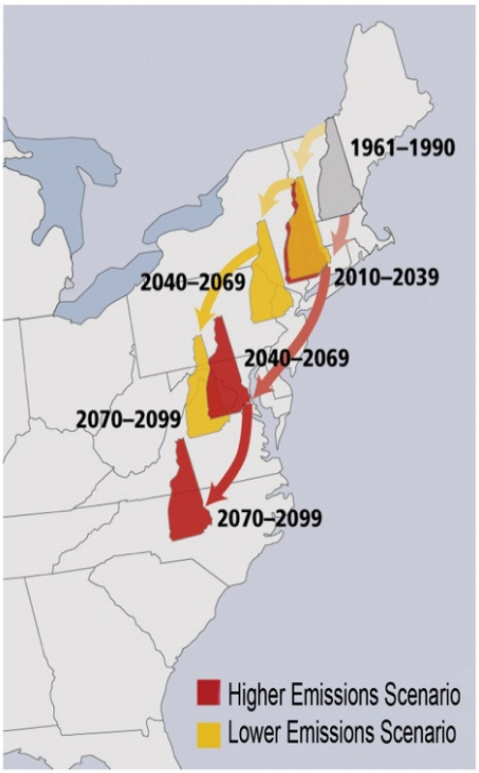
Winters are cold and snowy throughout the state. Extreme snow is often associated with a nor'easters. Lighter snowfalls frequently occur throughout winter (up to several inches), often associated with a northwest storm called an Alberta Clipper. In regard to summer storms, extreme precipitation events were rare in the past, although may be becoming more common. Extreme subtropical storms are limited, and NH rarely experiences a direct hit by hurricanes and tropical storms. When storms reach the state they are often extra-tropical, with most storms striking the southern New England coastline and moving inland or passing by offshore in the Gulf of Maine. Most of New Hampshire averages fewer than 20 days of thunderstorms per year and an average of 2 tornadoes occur annually statewide.

Our traditional climate is changing. According to data from the National Climate Assessment, average annual temperatures have increased by 2° F, and annual precipitation has increased by 5° (~10%). The Northeast has experienced a greater increase in extreme precipitation than any other region in the United States. Between 1958 and 2010, the Northeast saw more than a 70% increase in the amount of precipitation falling in very heavy events.

Over the past century (1895-2011) there has been an increasing trend in average temperatures, and precipitation in the form of rain and snow. Over the past 30 years the rate of warming has increased, with the winters significantly less cold and the summers slightly warmer. Coastal flooding has increased due to a rise in sea level of approximately 1 foot since 1900. In regard to extreme temperature trends, the number of very hot days (over 90^{o}) has not shown a significant increasing trend, although the number of very cold days (below 32^{o}) has seen a decreasing trend for a number of weather stations in NH according to a study of Southern NH.

"If emissions continue to grow unabated, New Hampshire can expect dramatic changes in climate over the course of this century, with substantial impacts on vital aspects of the state's economy and character." - *Northeast Climate Impacts Assessment (NECIA), 2006*

The amount of snowfall shows no distinct trend across southern New Hampshire, although the number of snow covered days (daily depth greater than 1") has decreased in recent decades. Over the past century, spring ice-out dates come earlier in the spring. In the past 40 years (since 1970), ice-out dates on Lakes Winnipesaukee and Sunapee occur about a week earlier. Important seasonal issues include a longer frost-free period that influences the length of pollen season and survival of vectors like ticks and mosquitoes that can transfer disease. Hotter and longer summer seasons can cause heat stress. More precipitation and severe weather can cause flooding and change the habitat for certain species such as ticks and mosquitoes.



The chart shows a projected change in New Hampshire's summer climate under two different greenhouse gas emissions scenarios over the next century. The yellow and red arrows track what the summer heat index may feel like based on lower or higher CO2 emissions. USGCRP (2009)

Figure X. Projected Change in Summer Heat Index, NH 1961-2099
See Appendix D for further detail on Climate Change in Southern and Northern NH

Contents of an Environmental Scan

What are your Health Priorities? Given the weather and climate impacts discussed in the previous section, begin to assess the priority health concerns for your community. Start by thinking 'big' with a review of regional health issues, and then focus in on issues that may be related to weather and climate. Your Advisory Council will discuss the impacts of severe weather and a changing climate on their populations. What weather-vulnerabilities are identified in your local hazard mitigation plan? Do they identify any high-risk populations? What health impacts do you expect based on these risks and populations? Create a list of the major climate-related risks, relevant health outcomes, and high-risk populations.

What Has Been Done So Far? Considering the weather hazards, changing climate and vulnerable populations in your region, what has been done so far to address these vulnerabilities? How can existing public health emergency preparedness plans and capabilities be applied to climate related issues? Create a list of the actions that have been taken so far.

What Needs To Be Done Now? Considering the regional strengths and gaps, what steps can be taken to reduce risks, protect the vulnerable, and adapt to the changing climate? Create a list of actions your community can to take that are evidence-based and realistic.

Adding Potential Partners: Considering the opportunities in front of you, who shares your goals and mission? What have past community needs assessments discovered about your region? What do local master plans say about actions to protect the community from flood or other climate-related risks? Who is identified in your local hazard mitigation plan? Make a list of potential partners and reach out to them and listen to their concerns. Involve them in the process.

Document Your Environmental Scan
Considering all the items above, create a summary page of your region's climate and a list of likely health priorities related to climate and weather, any actions your community has taken to address these issues already, the gaps and actions that need to be taken, and a list of existing and potential partners.

Summary Action Steps for Phase 1: Environmental Scan

- ✓ Organize a meeting with your Advisory Council* and Network partners to brainstorm an environmental scan; utilize a trusted facilitator
- ✓ Brainstorm ideas on 1) health priorities, 2) past actions, 3) future needs, 4) additional partners
- ✓ Reach out to additional partners to gain participation
- ✓ Document Environmental Scan by creating a list of:
  - ❖ major climate/weather risks and high-risk populations
  - ❖ actions taken so far
  - ❖ actions you need to take
  - ❖ potential partners to contact & involve
- ✓ Create an environmental scan summary & distribute it for further input from current and new partners
- ✓ Finalize Scan

Phase 2: BRACING for Change: How to Create a Climate & Health Adaptation Plan

Climate and Health Adaptation Planning is a process where the short-term activities lead to longer-term improvements in public health outcomes.

The Center for Disease Control and Prevention in Atlanta has developed a simplified process called the 'BRACE' framework (Building Resilience Against Climate Effects). At its heart, BRACE is a quality improvement process that guides you through the steps of assessment, choosing priorities, discovering solutions, taking action, and measuring your progress. The steps are outlined below and described in more detail later. But at their core they are:

Step 1: Forecasting climate impacts and assessing vulnerabilities
Step 2: Projecting disease burden
Step 3: Assessing public health interventions
Step 4: Developing and implementing a Climate Health Adaptation Plan
Step 5: Evaluating impact and improving quality of activities

BRACE as a planning framework for public health agencies

Using the BRACE framework a jurisdiction can develop strategies and programs to confront the health implications of changing weather and climate. Working with state agency staff and researchers, you will need to understand and incorporate some technical information into the planning process. You don't have to be an expert in complex atmospheric data, but you will need to assess some of the existing short and long range climate projections into public health planning and response activities.

Blending climate change projections with public health and disease data enables communities to more effectively anticipate, prepare for, and respond to a range of health impacts from weather or climate. Your RPHN's approach to planning, training, and responding to climate and weather-related health impacts can be improved by incorporating emerging information on our changing climate.

Exploring the five sequential steps in the BRACE Framework:

Step 1 -- Forecasting Climate Impacts and Assessing Vulnerabilities: This is where public health partners identify the scope of the most likely climate impacts, the potential health outcomes associated with those climatic changes, and the populations and locations vulnerable to these health impacts within a jurisdiction

The first step is a local assessment for 'Forecasting Climate Impacts and Assessing Vulnerabilities. At the regional level, you can use the following existing tools to help you in this process.

- DHHS query tool for Estimating Current Social Vulnerability
- USGS Tools for viewing your watershed Flood Inundation Mapper
- USGS Tools for assessing Drought Vulnerability
- UNH Web Tools to Display Climate Change Vulnerabilities
- UNH Report on Projected Climate Change in Southern and Northern NH
- Sample table for listing impacts and vulnerabilities in your region
- Sample table for listing collaborations and partnerships

Step 2 -- Projecting Disease Burden: Working with NH DHHS, the local health department estimates the additional burden of health outcomes associated with extreme weather events and/or climate change.

The second step is 'Projecting Disease Burden' where a RPHN (in cooperation with the NH DHHS) reviews past disease trends to estimate the future burden of health outcomes due to climate change. The information is used to support prioritization and decision making. This is the most challenging part of climate and health planning. Rarely does a health agency know exactly how health outcomes will change in the future, but with an aging population and changing climate, it is clear that future health trends will be predictably different.

Based on America's Health Rankings, New Hampshire currently ranks 7th in the US. Each county receives two scores: one for *health outcomes* and a second for *health factors*. Each of these scores represents a weighted summary of a number of measures. Health outcomes represent how healthy a county is while health factors represent what influences the health of the county.

Rank	Health Outcomes	Rank	Health Factors
1	Rockingham	1	Rockingham
2	Grafton	2	Merrimack
3	Hillsborough	3	Grafton
4	Merrimack	4	Cheshire
5	Cheshire	5	Hillsborough
6	Belknap	6	Carroll
7	Carroll	7	Belknap
8	Strafford	8	Sullivan
9	Sullivan	9	Strafford
10	Coos	10	Coos

At the regional level, you can use the following tools to help you in this process.

- WISDOM query tool for current NH disease counts, rates and deaths
- UNH HealthMap query tool for projecting future disease rates
- Local Community Health Improvement Plans (CHIPs) – Available Autumn 2015
- Sample table for listing health impacts in your region

See Appendix E

Step 3 -- Assessing Public Health Interventions: Identify the most suitable health interventions for the health impacts of greatest concern.

The third step is finding solutions to the problem, where a RPHN and its public health partners seek to identify the most suitable health interventions for priority health issues. The climate vulnerabilities and climate-related health impacts have been quantified in the previous steps.

Your objective is to develop a set of interventions that **fit your local communities, are evidence-based, and can be implemented and evaluated for as long as is necessary to see an impact in your area**.

At the regional level, you can use the following tools to help you in this process.

- CENTERS FOR DISEASE CONTROL AND PREVENTION Community Health Guide – a guide to evidence-based public health interventions
- NH DHHS State Health Improvement Plan (SHIP) – See weather-related interventions in four sections on Injury Prevention, Asthma Control, Vector-borne Disease, and Emergency Preparedness
- Sample table for listing public health interventions for your region

* *See Appendix F*

Step 4 -- Developing and Implementing a Climate and Health Adaptation Plan: Create an action plan for climate change that addresses priority health issues, identifies gaps in critical public health functions/services, and outlines necessary enhancement of adaptive capacity in the jurisdiction.

The fourth step is creating a viable plan-of-action, where a health department creates a set of linked goals, objectives, and activities that addresses priority health issues, identifies gaps in critical public health functions/services, and outlines necessary enhancement of adaptive capacity in the jurisdiction.

Only a few of these health-focused climate adaptation plans have been launched, and even fewer have been implemented or evaluated. Not many jurisdictions have been able to report on evaluation measures at this stage. So, you are on the leading edge of climate adaptation planning for public health. A set of sample plans is provided below.

At the regional level, you can use the following tools to help you in this process.

- Vermont report on Climate Change Health Effects Adaptation at the state level
- Massachusetts report on Climate Change Adaptation for human health and welfare
- Oregon Climate & Health Adaptation Planning for County Health Agencies
- California Climate Action for Health for integrating health into other plans
- NH Climate and Health State-Level Strategic Plan of Action
- NH DES Climate Adaptation Toolkit for NH Communities
- Keene NH Adapting to Climate Change: Planning a Climate Resilient Community
- Georgetown Climate Center Adaptation Clearinghouse for energy policies
- Sample template for the elements of a Climate & Health Adaptation Plan

Step 5 -- Evaluating Impact and Improving Quality of Activities: Create a logic model of the steps you will take to reach your chosen outcomes, select the appropriate strategies, determine the value of utilizing this planning framework, and outline the expected impact of climate and health activities undertaken.

The fifth, and final, step is the quality improvement phase – whereby a health agency can evaluate the processes it has used, determine the value of utilizing the planning framework, the activities undertaken (output), the effects that have been achieved either short term or long term (outcomes) and/or the resulting overall effect on health (impact or ROI). This step is also important for quality improvement and to incorporate refined inputs such as updated data or new information.

Measurement can be clustered into four arenas of study:

1. Cognitive -- changes in awareness, knowledge levels, understanding of risk;
2. Affective -- connection, satisfaction, engagement, empowerment;
3. Behavioral -- participation, sharing, volunteering, advocating, feedback, innovation, capacity building;
4. Structural -- areas that allow progress to continue like infrastructure (staffing, funding, future planning), commitment (by partners), connection (between partners).

A good evaluation program should measure all of the above -- and can be done without great expense. Evaluation will be explored in depth during the training sessions and a plan of action will be established. Also, the reports and samples below can help prepare you for this process:

- An overview of the Evidence-Based Public Health Approach to Climate Change Adaptation is provided in this peer-reviewed journal article.
- Michigan Process Evaluation for the Climate and Health Program
- Florida Climate & Health Evaluation Plan (to be posted via NH DHHS)
- Wisconsin C&H Evaluation Plan (to be posted via NH DHHS)
- Sample template for the elements of a Program Evaluation Plan for your region

A checklist for what the written adaptation plan will contain:

Documenting at least three (3) vulnerable populations and three (3) health outcomes relevant to the existing climate vulnerabilities. The draft plan can be hard copy or web-based.	✓
A set of strategies and action steps that include at least two (2) viable interventions that address regional weather or climate vulnerabilities and evaluation measures.	
A list that shows the number of existing local and/or regional hazard vulnerability assessments and mitigation plans reviewed to identify areas related to climate change impacts.	
A list that shows the number and affiliation of regional entities participating in the planning process.	
A table that identifies and prioritizes health impacts related to climate change; links each of these impacts to vulnerable populations; and describes the size and geographic distribution of	

vulnerable populations.	
A summary table that lists the local risks and public health resources identified in local, regional and state hazard mitigation plans, and notes any gaps in emergency preparedness capabilities related to extreme weather events and changes to the regional climate.	
A logic model that shows the overall inputs and outputs of the process.	

Now that you've walked through the BRACE framework steps, this guide will lead you through how to choose an intervention to address the climate or weather concerns in your region.

Summary Action Steps for Phase 2: The FIVE steps in the BRACE framework to implement:

Step 1: Forecasting climate impacts and assessing vulnerabilities
Step 2: Projecting disease burden
Step 3: Assessing public health interventions
Step 4: Developing and implementing a Climate Health Adaptation Plan
Step 5: Evaluating impact and improving quality of activities

Phase 3: Best Practices: How to Intervene from a Public Health Perspective

Once you have chosen your region's priority health outcomes related to weather and climate risks, you can explore which actions might best address these vulnerabilities. In the realm of public health, the best possible action would be an activity called an **'evidence-based public health intervention'**.

Evidence-based public health interventions have been proven to be effective in the past, for a specific population at-risk, and are backed up by a set of studies in peer-reviewed journals or reports.

They might be a single intervention, such as going into a home environment of an asthmatic child and removing allergens from the bedroom so they can have a 'safe haven'. Or, the action could be a multi-factorial intervention for obesity that is implemented by multiple agencies focused on diet and physical activity in the home, school, and at work.

Evidence-based interventions may not be available for all climate-related health outcomes, so you may want to propose an intermediate metrics of success related to building community resilience.

A good public health intervention should be focused on prevention of the cause, rather than treatment of the symptom. A good intervention should also be based on a strong knowledge of local health data -- that is, someone has analyzed the trends in behaviors, risk factors and the health outcomes in a way that makes you confident there is a real, focused, measurable problem that exists and can be addressed.

One of the ways to assess if a public health intervention is right for the community is to pose a few questions. Ask yourself (and the advisory group) to answer these questions:

> *Q. Can our region afford to do the intervention now, and can they continue to act over time, even if original seed funding runs out?*
> *Q. Will the intervention be accepted in the community, and does it fit the social and cultural norms of the major population groups?*
> *Q. Are other organizations already doing something very similar that we can join or emulate? Have they already filled the niche for this action or population or would it make sense to piggyback on the effort to achieve even greater results?*

Another way to prioritize interventions is to **identify the populations at-risk for various climate or weather vulnerabilities** and design interventions that will reduce exposure and/ improve health.

- Refer to the list you created of the local extreme weather and climate vulnerabilities in the local hazard mitigation plan,
- Refer to the list you created on the populations affected and where they live, work, study or play. For instance, think of people who are in flood plains or storm surge areas, or suffer from asthma.
- Refer to the list you created to identify the populations with greater resilience within your community. For instance, in a flood, think of the people who have access and skills in first aid and sanitation. In a winter storm, think of the people who are part of the local snowmobile club and can move easily over snow and ice. In a heat wave, think of the people who have pools or cooled buildings (i.e. malls, movie theatres) who can provide relief for many people at once. These resources may be the volunteer and support system that make for an effective intervention – and a more resilient community.

The next step is to choose a set of possible interventions for the specific health outcome. As described in a previous summary section on the BRACE process, your objective is to develop a set of interventions that fit your local community, are evidence-based, and can be implemented quickly and effectively.

Choose at least two climate-related health outcomes, and then begin to research which interventions might fit your community and population. Start by:

- Outlining the health impacts of concern, and create a list of the likely interventions.
- Reading about your topic in the Center for Disease Control and Prevention's Community Health Guide to see if there are any evidence-based public health interventions recommended for your topic area.
- Reading the NH DHHS State Health Improvement Plan (SHIP) for a discussion of health issues that may be weather-related. Examples include the four sections on Injury Prevention, Asthma Control, Vector-borne Disease, and Emergency Preparedness. Each section provides a clear picture of the health topic area, the baseline statistics and realistic goals, examples of existing interventions, stories from the field, partners for collaboration, and a detailed list of recommended actions for the future.

A review of the process for evidence-based interventions for climate and health has been published, with a focus on extreme heat events. The process outlined in this article may be a bit too involved for your needs, so plan to use intervention summary articles and reviews to guide you, rather than attempting to read all the relevant peer-reviewed literature.

Another alternative is to ask advice from specific program area staff (asthma, injury prevention, infectious disease etc.) at the NH DHHS, or create a contract with your local Regional Planning Commission (RPC). It is helpful to use the experience of others to determine if evidence-based interventions have already been used in New Hampshire among a population similar to the one in your region.

**Appendix G offers sample templates for a Climate Adaptation Plan and Evaluation Model*

Looking at the Adaptation Plan in a Logical Way

A good adaptation plan includes a big picture of how you will reach your end goal. **A logic model diagram** is needed at this step in order to ensure that all the resources and activities are in place to reach your desired goal. Provided below is a sample logic model for the state-level climate and health plan in New Hampshire. Once you have chosen a health outcome relevant to your community, your next step should be to create a logic model to explain the steps to reach your long-term goal.

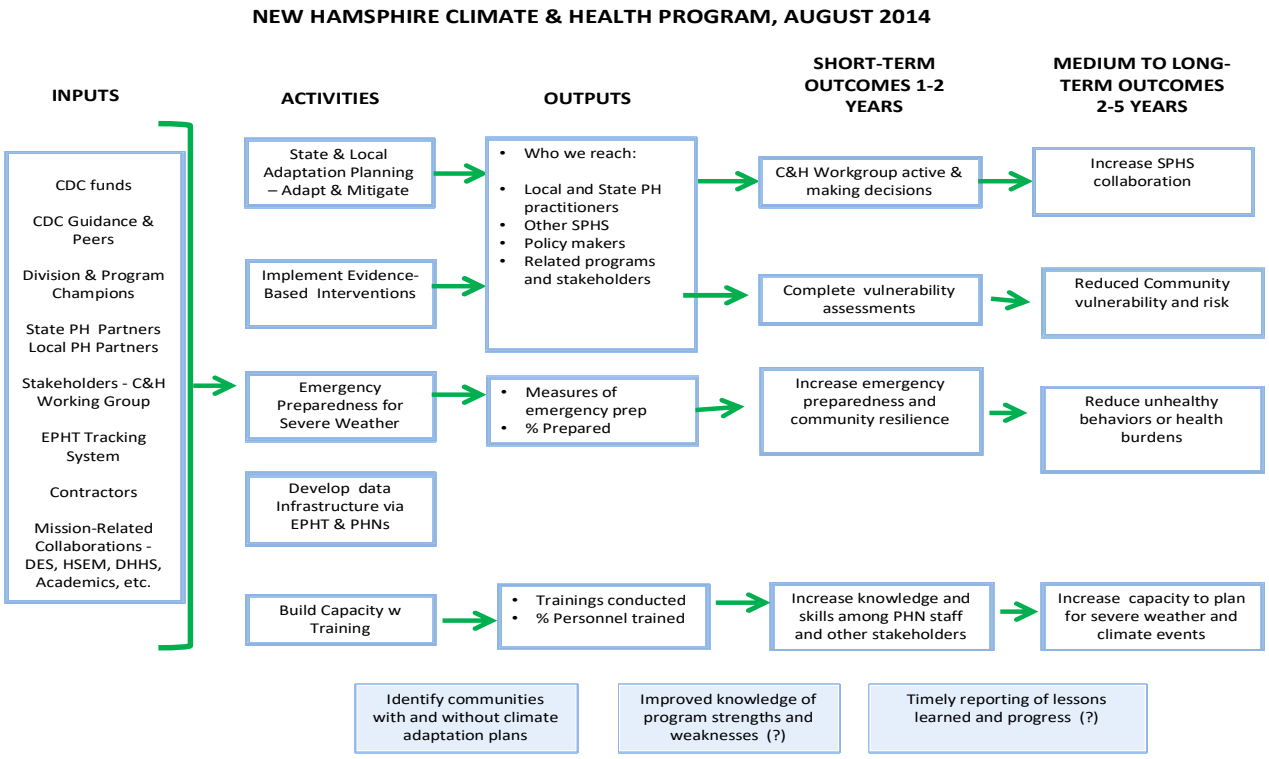


Figure X. General Program Logic Model (not specific to a single health outcome)

Now that you have gathered information on how to intervene, you can **put what you have learned into a table format**. Review the sample matrix below and create your own table of information on how to develop an intervention for a climate or weather related health risk.

Environmental Exposures	Health Effects & Impacts	Baseline Public Health Data	Goal for Reduction of Health Impact	Intervention Type	Intervention Strategy	Intervention Activity
Increased Temperature and Excess Heat Days (increase in number of days over 90F) from 200-400%	Increased heat stress leads to **heat-related illness and mortality**	Average count of 125 heat-related hospital visits per year (1998-2009) WISDOM 2014	Reduce rate of heat-related hospital visits from x toy in your geographic area by 2020	Primary prevention, before heat injury occurs	Option 1. Create an AC unit loaner program	Reduce high temps in the homes of at-risk elders
				Secondary prevention, after heat stress begins	Option 2. Improve access to cooling centers	Improve public awareness of cooling centers
				Tertiary prevention, after heat injury begins	Option 3. Train home-visitors to identify and treat heat injury	Treat elderly for heat stress by cooling or transport to hospital

Figure X. Sample Table for Listing Public Health Interventions. See additional samples in Appendix F.

Once you have chosen your interventions, you can develop an action plan to apply them in your own community. The next section describes the process of putting the action plan into effect.

Summary Action Steps for Phase 3: How to Intervene

- ❖ Look for 'evidence-based' public health interventions
- ❖ Focus on prevention of the cause, rather than treatment of the problem
- ❖ Base choices on a strong knowledge of local health data
- ❖ Identify populations at-risk
- ❖ Choose two climate-related health outcomes
- ❖ Choose a set of possible interventions
- ❖ Research which interventions might fit your community and population
- ❖ Create a logic model diagram
- ❖ Put collected information into a table format

Phase 4: A Call to Action: How to Carry Out the Plan

Now it is time to implement your plan of action! This section provides recommendations on how to do that in an effective and timely manner.

Recommendations for action:

- ❖ **Focus on local climate vulnerabilities and populations**. Create climate and health adaptation plans that fit local needs, local populations, and build greater community resilience in response to severe weather and climate change.

- ❖ **Focus on short-term issues**. Climate adaptation plans have a primary focus on short-term solutions to the current challenges (longer seasons, hotter days, heavier rain, etc.) and may have a secondary focus on the long-term drivers of climate change (like greenhouse gases and deforestation).

- ❖ **View climate as part of other health plans**. A comprehensive climate adaptation process should integrate well into other community health planning efforts. A good plan should reflect the threats outlined in a municipal hazard mitigation plan. A good plan should also blend with the health issues identified in your local hospital's community health improvement plan, or a RPHNs hazard vulnerability assessment.

- **Focus on health topics.** Weather events and climate are already important drivers of significant health problems in our communities, including allergies, asthma, heat/cold injuries, and infectious disease to name a few. Keep your efforts focused on health outcomes, even if you have to take intermediate steps to get there.

- **Think globally and act locally.** Due to the wide variation in topography, weather, and climate hazards across New Hampshire, a local or regional approach is better than a single state plan. In order to plan and adapt to the global problem of climate change, we need to know the local vulnerabilities in the low-lying coastal areas (storm surge, high tides, drought), and the steep terrain of the White Mountains (flash floods, wildfires, heavier snow) and land development challenges of the urban areas of the Southern tier (urban heat islands, flooding, congested traffic, poverty, etc.).

- **Use the project to build partnerships**. Some of the secondary benefits of local climate-health adaptation planning include raising awareness of climate change issues as a way to address injury prevention, healthy housing, infectious disease, and emergency preparedness. Climate and weather adaptation efforts also open up new pathways for funding and collaboration initiatives in specific regions. Although public health funding is often limited, there are many organizations that provide funds to support climate action, environmental activities, and energy efficiency actions.

- **Use adaptation projects to build community awareness**. Another advantage of adaptation planning includes the ability to create synergy with existing Public Health Network goals:
  - Identifying new topics of interest to the community
  - Identifying new members to join the PHN Advisory Council
  - Strengthening existing partnerships in the Network, or adding new partners
  - Creating a focal point for seasonal outreach across the summer, fall, winter and spring

- **Include the health sector**. Your 'charge' is to use this guidance document to design an Climate Health Adaptation Plan that addresses local public health issues. Remember to involve existing staff from the public health and health care sectors, and find ways to help the health sector adapt to severe weather and a changing climate so they can help others.

Timeline of activities:

The following table shows the **estimated dates** for the various adaptation planning activities. Use these dates as a general guide to develop your own work plan and reach the key due dates. It is expected that your organization will develop its own timeline of activities and include the due dates listed here.

Estimated Dates	Activity or Product
May 2015	Projected Start of funding phase 1: Planning Activities for two RPHNs
May 1,2015	DHHS holds a kick-off meeting with PHNs in Concord NH to discuss the project, and gather wants and needs.
May-June 2015	Grantees engage advisory council in regional assessment, to discuss resources, vulnerabilities, health burdens, interventions, plan of action and evaluation measures.
May-June 2015	DHHS holds regional meeting(s) to provide training in BRACE resilience framework
June 2015	Grantees develop a draft plan of action for climate adaptation
Wednesday, June 30, 2015	**Due Date:** Grantees send draft climate health adaptation plan to DHHS
July 2015	DHHS sends back comments on plans
August 2015	Grantees prioritize hazards, health impacts and at least two viable interventions
Wednesday, September 30, 2015	**Due Date:** Grantees send final report to DHHS
	Depending on funding availability…
October 2015	*Projected Start of funding phase 2: Intervention Activities (9 months)*
October 2015	*Add funding for two additional RPHNs to begin climate planning activities*
November 2015	*Grantees choose one intervention to implement at local level*
Oct – June	*Grantees implement and measure progress*
June 2016	*Grantees report on progress*
Wednesday, June 30, 2016	*End of second phase*

Table X. Preliminary Timeline of Activities for Weather and Climate Adaptation Process

Summary Action Steps for Phase 4:

We have reviewed how to carry out the adaptation plan -- now you will need to begin writing it. Start by outlining the elements of the plan, a timeline and a way to budget your time and money. If you have questions about the process, you can also **contact the resources** listed below.

** Appendix I has further resources and supporting data.*

For More Information:

For all climate and health questions:

Matt Cahillane, Program Manager
Climate and Public Health Program
NH DHHS/DPHS/Bureau of Public Health Protection
29 Hazen Drive, Concord, NH 03301-6504
mcahilla@dhhs.state.nh.us
Phone: 603.271.4072

For all Public Health Network related questions:

Neil Twitchell, Administrator
Community Health Development Section
NH Division of Public Health Services
29 Hazen Drive, Concord, NH 03301
NTwitchell@dhhs.state.nh.us
Phone: 603.271.5194

For all Regional Planning related questions:

The New Hampshire Association of Regional Planning Commissions (NHARPC) is the affiliation of the nine regional planning commissions in the state of New Hampshire.

Becky Baldwin, Office Manager
37 Ashuelot Street
Keene, NH 03431
603-357-0557
bbaldwin@swrpc.org
http://www.nharpc.org/about-us

Appendices

Appendix A: Terminology and Acronyms

Climate adaptation – Adapting to climate change is the ability to reduce the impacts of a warmer, wetter, and stormier world.

Climate mitigation – Mitigating climate change is the ability to reduce the drivers of change, such as reducing greenhouse gases or maintaining forests to absorb excess carbon dioxide.

Resilience – Community resilience is the ability of a population to bounce back from a stressor, like a severe storm or disaster.

Vulnerability – Community vulnerability is a measure of those characteristics that make it hard to bounce back, such as poverty, disability, chronic disease, or old age.

Weather Events – Weather is a one-time event that might occur today, this week, or this year. http://www.nws.noaa.gov/om/csd/index.php?section=cVSw

Climate Patterns – Climate is a pattern that emerges when these weather events occur over and over again in a predictable way. http://www.nws.noaa.gov/om/csd/index.php?section=cVSw

Public Health – The science and art of preventing disease, prolonging life and promoting health through the organized efforts and informed choices of society, organizations, public and private, communities and individuals. Epidemiology is the core science of public health, and focuses on discovering the patterns of disease by using health statistics and applying actions that prevent rather than treat disease.

Morbidity – refers to the disease state of an individual or the incidence of illness in a population. Co-morbidity is the simultaneous presence of two or more medical conditions, such as schizophrenia and substance abuse or obesity and diabetes.

Mortality –The number of deaths (due to all causes, or due to a specific cause) in a population, scaled to the size of that population, per unit of time.

Local Emergency Operations Plan - TBD

Hazard Mitigation Plan - TBD

Appendix B: Engaging the Advisory Council – Sample Questions for Discussion

A few questions the PHN Advisory Council can begin asking include:

1) What kind of severe weather events affect my region, and how often?

✓	Weather Event	How often?
	Thunderstorms and wind damage	
	Winter snow and ice	
	Coastal storm surge	
	Forest wildfires	
	Urban heat waves	
	River flooding	
	Other	

2) What are the needs in my region related to weather and climate? And is our Advisory Council ready to determine how this initiative fits the needs of the public health region? Does the Advisory Council need to study or learn more before it begins?

_____

_____

3) How can you maintain an active role for the Council's advisory throughout the project period?

_____

_____

4) What target audiences would our region like to focus on – public health professionals, emergency responders, health care providers, at-risk populations, or the general public?

_____

_____

5) How can we coordinate our plans with other public health efforts – such as mental health, physical fitness, obesity, emergency preparedness, or other regional priorities?

_____

_____

6) What partners can you involve to carry out the scope of work (i.e. planning)?

_____

_____

7) How can the scope of work be effectively implemented?

_____

_____

8) What public health interventions will be the most effective? Can you afford to do the intervention now, and can you continue the work over time, even if the original seed funding runs out?

_____

_____

9) How will the intervention be accepted in the community, and does it fit the social and cultural norms of the major population group?

_____

_____

10) Have other organizations already been doing something very similar that you can join or emulate, or has someone else already filled the niche for this action or population?

_____

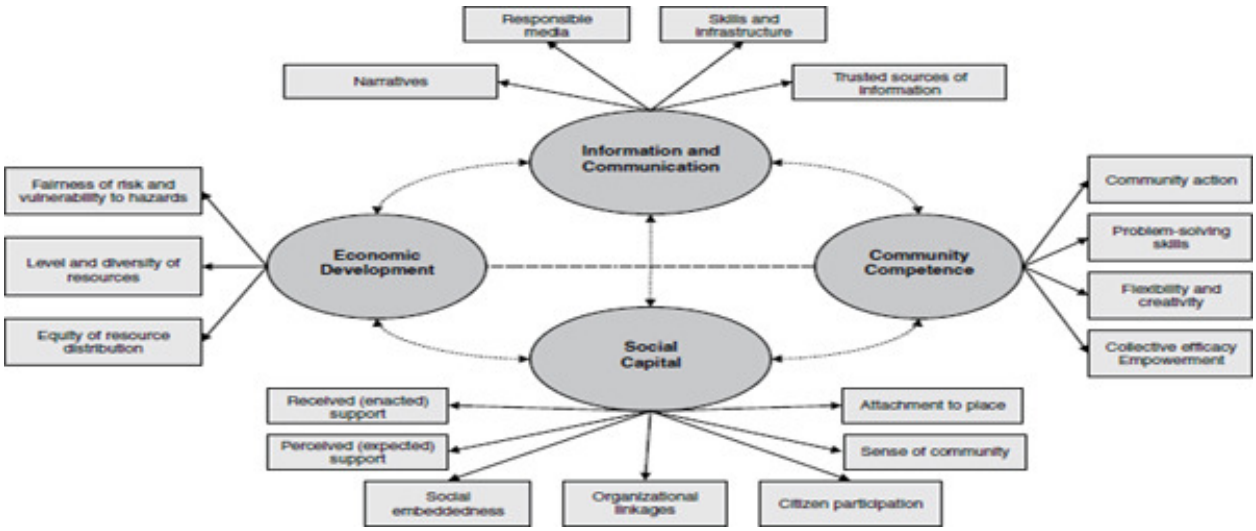
_____

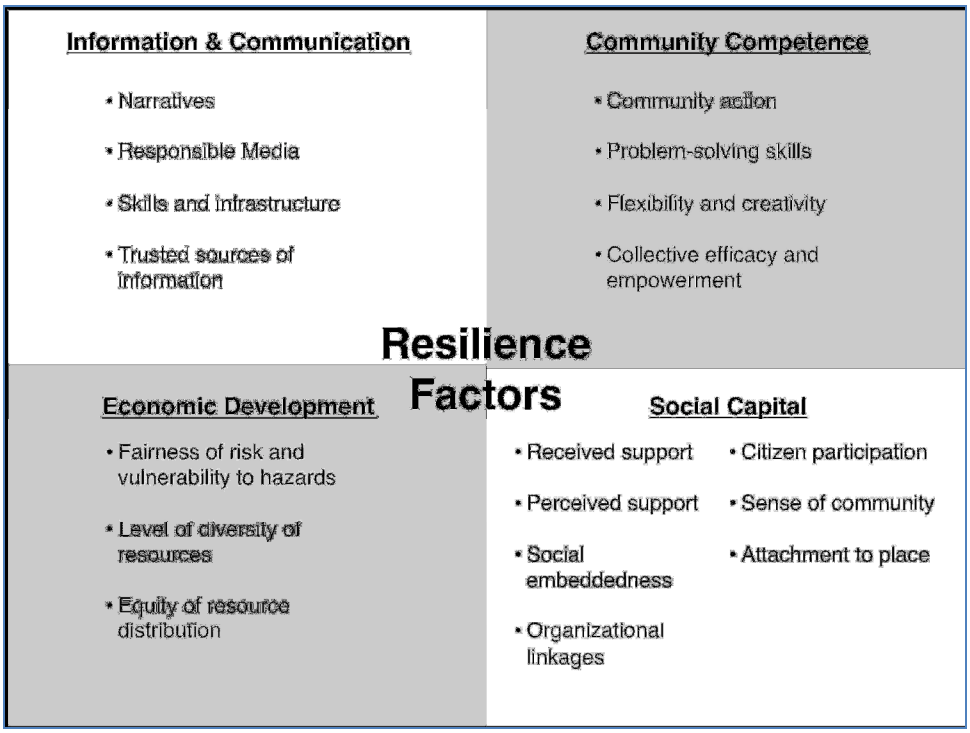
Appendix C: Measuring Resilience

The following figure can be used to brainstorm about likely strategies and interventions that may work to build community resilience. As you build your list of actions to take, make sure they can be directly linked to long-term public health outcomes. Choose one of the four areas of resilience in the ovals below, and then talk about how you might measure progress towards improving resilience in an area needed by your community.

For example, if you believe that 'Information and Communication' is the best area to build resilience, then you might consider having public health or medical professionals write "Narratives" about severe weather events and health impacts they have experienced. The narratives could be combined together to create a story via a media strategy (film, radio, local TV, newspaper, etc.) that talks about community resilience in relation to health outcomes. A community member could tell a story about how a flood damaged their home and affected a person with allergies or asthma and actions they took to reduce risk of future flooding.

Figure X. Diagram of Community Resilience Factors and Related Strategies or Interventions. Norris 2007.




Information & Communication
• Narratives
• Responsible Media
• Skills and infrastructure
• Trusted sources of information
Community Competence
• Community action
• Problem-solving skills
• Flexibility and creativity
• Collective efficacy and empowerment
Resilience Factors
Economic Development
• Fairness of risk and vulnerability to hazards
• Level of diversity of resources
• Equity of resource distribution
Social Capital
• Received support
• Perceived support
• Social embeddedness
• Organizational linkages
• Citizen participation
• Sense of community
• Attachment to place

Appendix D: Projections of Climate Change in Southern and Northern NH

Table of Climate Change Projections for Northern NH Temperature, Precipitation, Growing Season and Snow Cover for New Hampshire. UNH Climate Solutions, 2014

Northern New Hampshire

Indicators	Historical* 1980–2009	Change from historical (+ or -)					
		Short Term 2010–2039		Medium Term 2040–2069		Long Term 2070–2099	
		Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions
Minimum Temperature (°F)							
Annual TMIN	31.5	1.9	2.1	3.1	5.4	4.1	9.2
Winter TMIN	8.5	2.6	2.9	4.1	6.4	5.7	10.7
Spring TMIN	29.3	3.2	1.7	5.0	4.6	6.2	8.0
Summer TMIN	52.5	1.6	2.1	2.8	5.5	3.4	9.5
Fall TMIN	37.5	0.2	1.8	0.5	5.1	1.0	8.5
Maximum Temperature (°F)							
Annual TMAX	53.9	1.8	1.8	3.2	5.0	4.3	8.5
Winter TMAX	29.3	2.0	1.8	2.8	3.9	4.1	6.7
Spring TMAX	52.6	2.5	1.6	4.9	4.8	6.6	8.8
Summer TMAX	77.0	1.8	2.1	3.4	5.8	4.2	9.6
Fall TMAX	56.4	1.0	1.7	1.4	5.5	1.6	8.7
Temperature Extreme (days per year)							
<32°F	178.0	-9.7	-11.3	-16.5	-26.3	-20.2	-45.5
<0°F	28.0	-7.1	-7.0	-11.0	-15.8	-13.4	-21.2
>90°F	3.4	2.3	3.0	6.7	14.4	10.3	34.9
>95°F	0.4	0.3	0.6	1.2	3.6	2.3	12.5
Temperature Extreme (°F)							
TMAX on hottest day of year	90.8	1.7	1.5	2.8	4.9	4.1	8.8
TMIN on coldest day of year	-21.8	4.0	4.2	5.9	10.4	7.9	18.3
Growing Season (days)	150	9	11	18	29	21	50
Precipitation (inches)							
Annual mean	43.2	3.5	2.2	4.4	5.2	6.2	7.3
Winter mean	8.9	1.1	0.9	1.3	1.5	1.8	2.4
Spring mean	10.1	1.0	0.8	1.7	1.6	1.9	2.5
Summer mean	12.6	1.4	0.4	0.6	1.4	1.9	0.7
Fall mean	11.5	0.1	0.2	0.9	0.9	0.8	1.7
Extreme Precipitation (events per year)							
1" in 24 hrs	8.1	1.1	1.1	1.8	2.3	2.4	4.7
2" in 48 hours	2.8	1.3	1.3	0.3	2.4	1.4	4.9
Extreme Precipitation (events per decade)							
4" in 48 hours	2.5	1.9	1.2	1.9	3.0	4.0	6.3
Snow-Covered Days	144	-14.6	-5.0	-19.3	-21.1	-27.3	-42.2

TABLE 9. Climate grid with historical and projected future 30-year climatologies for temperature (fifteen stations) and precipitation (twenty-three stations) variables averaged across northern New Hampshire (i.e., north of 43.75° north latitude). Daily meteorological data was not available for all sites for the entire period of record, so the historical values (1980–2009) in these tables were derived from the downscaled GCM simulations. A climate grid for each of the fifteen GHCN-Daily stations that recorded both temperature and precipitation are provided in Appendix B.

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Table of Climate Change Projections for Southern NH Temperature, Precipitation, Growing Season and Snow Cover for New Hampshire. UNH Climate Solutions, 2014.

Southern New Hampshire

Indicators	Historical* 1980–2009	Change from historical (+ or -)					
		Short Term 2010–2039		Medium Term 2040–2069		Long Term 2070–2099	
		Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions
Minimum Temperature (°F)							
Annual TMIN	34.5	1.7	2.0	2.9	5.1	3.8	8.8
Winter TMIN	12.8	2.3	2.6	3.6	5.6	5.0	9.3
Spring TMIN	31.2	4.0	2.5	5.6	5.2	6.8	8.5
Summer TMIN	54.9	1.6	2.2	2.8	5.6	3.5	9.8
Fall TMIN	35.3	0.3	1.7	0.6	5.0	1.1	8.3
Maximum Temperature (°F)							
Annual TMAX	57.2	1.7	1.7	3.0	4.8	4.1	8.3
Winter TMAX	33.4	1.7	1.6	2.5	3.5	3.6	6.1
Spring TMAX	55.7	2.5	1.5	4.9	4.7	6.6	8.7
Summer TMAX	79.6	1.8	2.1	3.3	5.7	4.1	9.6
Fall TMAX	59.7	0.9	1.7	1.3	5.3	1.5	8.6
Temperature Extreme (days per year)							
<32°F	164.0	-9.5	-10.9	-15.8	-25.5	-19.5	-43.9
<0°F	16.0	-5.0	-5.1	-7.8	-10.6	-9.0	-14.2
>90°F	6.7	4.2	5.2	11.1	21.7	16.2	47.3
>95°F	1.0	0.8	1.2	2.7	7.0	5.1	21.8
TMAX on hottest day of year	93.1	1.8	1.4	3.0	4.8	4.6	9.0
TMIN on coldest day of year	-15.8	4.0	4.4	6.2	10.2	8.0	17.4
Growing Season (days)	162	11.1	12.0	17.0	28.6	20.4	48.7
Precipitation (inches)							
Annual mean	43.8	4.3	3.1	5.4	5.9	7.4	8.8
Winter mean	9.8	1.2	0.9	1.5	1.5	2.1	2.9
Spring mean	10.9	1.1	1.1	1.7	1.6	2.1	2.7
Summer mean	11.4	1.7	1.0	1.3	2.0	2.2	1.6
Fall mean	11.6	0.5	0.2	1.0	0.9	1.1	1.6
Extreme Precipitation (events per year)							
1" in 24 hrs	10.4	1.6	1.6	2.2	2.8	2.9	4.3
2" in 48 hours	3.7	2.0	2.0	1.0	3.0	1.5	4.2
Extreme Precipitation (events per decade)							
4" in 48 hours	4.3	2.6	0.7	3.9	4.0	6.1	7.6
Snow-Covered Days	105	-9.6	-16.3	-15.0	-37.1	-23.7	-52.9

TABLE 9. Climate grid with historical and projected future 30-year climatologies for temperature (25 stations) and precipitation (41 stations) variables averaged across southern New Hampshire (south of 43.9° north latitude). Daily meteorological data was not available for all sites for the entire period of record, so the historical values (1980–2009) in these tables were derived from the downscaled GCM simulations. A climate grid for each of the 25 GHCN-Daily stations that recorded both temperature and precipitation are provided in Appendix B.

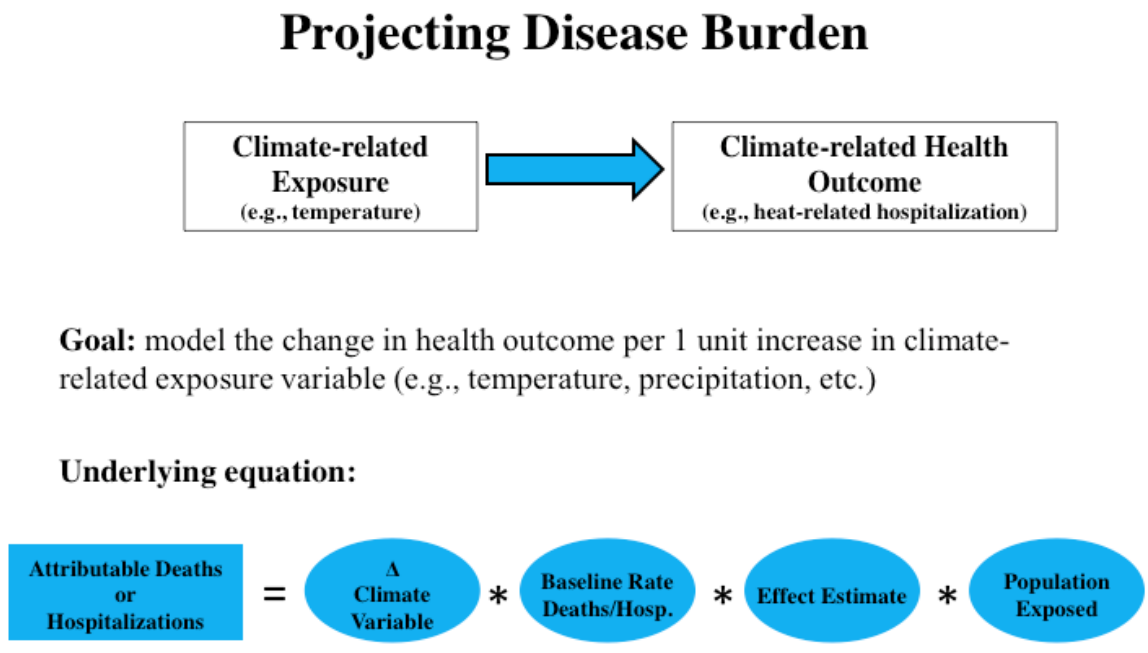
Appendix E: Projecting Disease Burdens & Evaluating Linkages Between Climate and Health

In creating a Climate Health Adaptation Plan, it is important to determine priority health issues to focus on. This prioritization can be based on current health trends as well as projections of future health trends.

The Attributable Risk equation below can be used to understand Exposure-Outcome Risk Estimates and project future disease burdens. Risk estimates can either be derived from the literature or from local, place-specific studies.

The goal of STEP 2 in the BRACE Framework is to estimate the magnitude and additional burden of health impacts caused by or associated with climate change in specific geographic areas. The results should allow state, local, and national partners to better understand, plan, and act on these public health issues. The expected project outcomes are a brief written report with actionable findings, and a set of final recommendations or conclusions.

Step 2 of the BRACE Framework will focus the scope of prior vulnerability assessment by providing future disease burden estimates that can help public health agencies choose what issues are of the highest priority for taking action. The public health community will use these data sources to: (a) understand projected climatic changes; (b) identify local weather/climate variability and human health relationships; and (c) obtain climate



change projections for quantifying the future disease burden.

Appendix F: Sample Tables for Assessing Climate Adaptation in your Region

The following tables may be used to outline your planning process, and document what you have been able to discover.

Table A. Sample Table of Climate Vulnerabilities, Health Impacts and Vulnerable Populations

Climate Exposure or Vulnerability	Pathways – direct & indirect	Health Effects & Impacts	Evidence for Relevance to your Region	Data Source for your Region	Priority for your Region
Increased Temperature and Excess Heat. (increase in days over 90℉)	**Increase indoor & outdoor heat**, people without cooling and outdoor workers suffer heat stress	Increased heat stress leads to heat injury and death			
Increased Heat (& sunlight)	Increase in **ozone pollution**, people inhale pollutants.	Increased asthma prevalence and related hospital visits, deaths			
Increased Heat (& sunlight)	Increase in **warm days for sun bathing**, people expose skin to sunlight more often	Increased skin damage, sunburns, and skin cancer			
Increased Extreme Precipitation	Increase in **days with heavy rain**, contaminated water runs into wells and rivers, people are exposed via drinking water and recreational swimming	Increased acute gastrointestinal illness (AGI)			
Longer Growing Seasons	Increase in the number of days over 32℉, **allergic plants bloom earlier and later**, people inhale greater amounts of pollen and/or more days of exposure.	Increased allergic rhinitis, sinus infections, allergic asthma			
Longer Growing Seasons	Increase in the number of days over 32℉, **extended season for disease vectors like ticks or mosquitoes,** people are bitten more often and exposed to more pathogens	Increased cases of diseases such as Lyme, EEE, and West Nile. Also emerging threats of Dengue and Chikungunya			
Threats to Mental Health	Direct effects of **post-disaster**	Increased cases of mental illness,			

	impacts on mental health, indirect effects of climate-induced stress from non-disaster economic and social stressors	or lack of ability to adapt to changing climate conditions			
Food Security	Direct effects for **loss off food sources** or quality of food	Increased cases of malnutrition, or stress from changing food supply			
Extreme Weather Events	Direct effects of **storm events**. Indirect effects of CO poisoning or mental stress. Indirect effects of food/water quality during emergencies. Indirect effects of mold following extreme events.	Increased cases of injury, trauma, or deaths; Increased cases of food/waterborne diseases; Increased cases of asthma, allergies and respiratory illness.			
Wildfires	Direct effects of **fire and smoke**. Indirect effects uncertain. *These seems nearly irrelevant for NH.	Increased injury and deaths			
Hydrologic change in watersheds	Direct effects of **flood and drought**. Indirect effects of economic damage and mental stress	Increased injury and death, mental stress from rapid change			

Table B. Vulnerable Populations and Places from Climate Change in New Hampshire. NH DHHS, 2014.

Environmental Exposures	Pathways – direct & indirect	Health Effects & Impacts	Vulnerable Populations and Places	Evidence for Risk to Populations	Locations of Populations At-Risk
Increased Temperature and Excess Heat. (increase in days over 90°F)	**Increase indoor & outdoor heat**, people without cooling and outdoor workers suffer heat stress	Increased heat stress leads to heat injury and death	People with lower income, elderly, those living alone or isolated or without AC.	TBD via use of Social Vulnerability Index	
Increased Heat (& sunlight)	Increase in **ozone pollution**, people inhale pollutants.	Increased asthma prevalence and related hospital visits, deaths	People with asthma, or COPD		
Increased Heat (& sunlight)	Increase in **warm days for sun bathing**, people expose skin to sunlight more often	Increased skin damage, sunburns, and skin cancer	All people, esp. those with light skin. All outdoor workers and recreational users.		
Increased Extreme Precipitation	Increase in **days with heavy rain**, contaminated water runs into wells and rivers, people are exposed via drinking water and recreational swimming	Increased acute gastrointestinal illness (AGI)	People with unprotected well heads. People on surface drinking water sources. Swimmers and recreational water users.		
Longer Growing Seasons	Increase in the number of days over 32', **allergic plants bloom earlier and later**, people inhale greater amounts of pollen and/or more days of exposure.	Increased allergic rhinitis, sinus infections, allergic asthma	People with allergic response to plant pollen.		
Longer Growing Seasons	Increase in the number of days over 32', **extended season for disease vectors like ticks or mosquitoes,** people are bitten more often and exposed to more pathogens	Increased cases of diseases such as Lyme, EEE, West Nile. Also emerging threats of Dengue and Chikungunya.	People living in areas with high tick or mosquito populations. People living in Lyme endemic areas.		

Threats to Mental Health	Direct effects of **post-disaster impacts on mental health**, indirect effects of climate-induced stress from non-disaster economic and social stressors	Increased cases of mental illness, or lack of ability to adapt to changing climate conditions	People living in disaster affected areas. Places with lower community resilience.
Food Security	Direct effects for **loss off food sources** or quality of food	Increased cases of malnutrition, or stress from changing food supply	People with lower income or less access to food choices
Extreme Weather Events	Direct effects of **injury and deaths**. Indirect effects of CO poisoning or mental stress. Indirect effects of food/water quality during emergencies. Indirect effects of mold following extreme events.	Increased cases of injury, trauma, or deaths. Increased cases of food/waterborne diseases; Increased cases of asthma, allergies and respiratory illness	People living in disaster affected areas.

Table C. Sample Table of Impacts to Track over Time – Baseline and Projections

Environmental Exposures	Health Effects & Impacts	Baseline Mortality Data in NH	Baseline Death Data in NH	Expert Opinion, NCA	Potential Health Burden due to Climate Change	Projected Health Burden in your Region
Increased Temperature and Excess Heat (increase in days over 90F) from 200-400%	Increased heat stress leads to **heat injury and death**	Average count of 125 heat-related hospital visits per year (1998-2009) WISDOM 2014	5 heat deaths per decade (2000-2010) WISDOM 2014	**Very high** confidence	Projected increase in heat deaths by one order of magnitude (100%) by 2099. UNH 2014, p.24	
Increased Heat (& sunlight)	Increased **asthma prevalence and related hospital visits**, deaths	Prevalence of 110,000 adults and 25,000 children. Over 7,200 visits per year. Rate of 65 ED visits per 10,000 (2000-09) DPHS 2010	Average count of 15 asthma deaths per year among NH residents. (2000-2006) DPHS 2010	**Very high** confidence	Projected increase in asthma hospital visits by 5-10% due to ozone by 2020. UNH 2014 p.37	
Increased Extreme Precipitation	Increased **acute gastrointestinal illness (AGI)**	TBD	TBD	**Very high** confidence	No projections at this time	
Longer Warm Season	Increased cases of **vector-borne diseases** such as Lyme, EEE, West Nile. Also emerging threats of Dengue and Chikungunya	Counts of Lyme disease cases average 1,472 per year. Rates of Lyme average 111 per 100,000 persons.	Deaths very rare, even in untreated cases	**Very High** confidence for shift in vector range. **Medium** confidence if human disease will follow.	Projected decrease in tick habitat by -1.6% for eastern US by 2020. Brownstein, 2005 No estimates found for change in VB disease	

		2008-2013. DPHS 2014			or Lyme, or habitat in the Northeast US.	
Threats to Mental Health	Increased cases of **mental illness**, or lack of ability to adapt to changing climate conditions			**Very High** confidence for post-disaster impacts. **Medium** confidence in climate-induced stress		
Food Security	Increased cases of malnutrition, or stress from changing food supply			**Medium** confidence in food quality	**High** confidence in food security	
Longer Pollen Growing Seasons	Increased allergic rhinitis, sinus infections, allergic asthma			**High** confidence		
Increased Heat (& sunlight)	Sunburn, skin cancer, melanoma			Not yet assessed		
Extreme Weather Events	Traumatic injury, drowning deaths			Not yet assessed		
Increased heat & food spoilage	Food-borne disease			Not yet assessed		
Harmful Algal Blooms				Not yet assessed		
Wildfires	Fire and smoke injury, deaths			Not yet assessed		

Table D. Sample Table of Collaborations Listed by BRACE Steps, Activities

BRACE Steps	BRACE Related Activities	Collaborations in New Hampshire	Collaborations in your Region
Step 1: Forecast Climate Impacts and Assess Vulnerabilities (Profile of State Climate & Health Activities)	Forecasting Climate Impacts and Assessing Vulnerabilities where a health department identifies the scope of the most likely climate impacts, the potential health outcomes associated with those climatic changes, and the populations and locations vulnerable to these health impacts within a jurisdiction	• Collaborate with stakeholders to form a NH C&H Working Group. • Collaborate with NH DHHS programs to assess baseline measures for health impacts, and complete profile of C&H activities in NH • Collaborate with DOS Homeland Security to assess hazard mitigation areas	•
Step 2: Project the Disease Burden	Projecting the Disease Burden where a health department, as best as possible estimates or quantifies the additional burden of health outcomes due to Climate Change – to support prioritization and decision making	• Collaborate with Plymouth State University (PSU) epidemiologist to assess health burdens. • Collaborate with NH DHHS programs to integrate climate issues into the State Health Improvement Plan and the Regional Hazard Mitigation Plans as a Climate-Health Adaptation Plan	•
Step 3: Assess the Viable Interventions	Assessing Public Health Interventions where a health department seeks to identify the most suitable health interventions for the health impacts of greatest concern	• Collaborate with contractors and stakeholders to assess evidence-based interventions for priority health burdens • Collaborate with local public health	•

		agencies to assess viability to implement actions in NH	
Step 4: Develop Adaptation Plans for Climate & Health	Developing and Implementing a Climate and Health Adaptation Plan where a health department develops and implements a health adaptation plan for climate change that addresses health impacts, gaps in critical public health functions/services, and a plan for enhancing adaptive capacity in the jurisdiction	• Collaborate with NH DHHS, DES, and local towns to find best format for adaptation plans • Contract with local Public Health Networks via mini-grants to create adaptation plans • Outreach with local public health professionals to engage on issues of severe weather and climate change	•
Step 5: Evaluate the Impact of the Activities	Evaluating Impact and Improving Quality of Activities step for the Framework – whereby a health department can evaluate the processes it has used, determine the value of utilizing the framework and the value of climate and health activities undertaken	• Collaborate with agency program improvement staff to develop evaluation plan • Link plan to ongoing quality improvement (QI) structure • Engage with stakeholders to improve activities and adaptation planning	•

Table E. Sample table for listing public health interventions for your region, using heat injury as an example.

Environmental Exposures	**Health Effects & Impacts**	**Baseline Public Health Data**	**Goal for Reduction of Health Impact**	**Intervention Type** Primary, secondary or tertiary	**Intervention Strategy**	**Intervention Activity**
Increased Temperature and Excess Heat (increase in days over 90F) from 200-400%	Increased heat stress leads to **heat injury and death**	Average count of 125 heat-related hospital visits per year (1998-2009) WISDOM 2014	Reduce rate of heat-related hospital visits from x to x in town z by 2020	Primary prevention	Create an AC loaner program	Reduce heat stress in the homes of at-risk elders
Increased Heat (& sunlight) Lead to Higher Ozone levels and poor air quality	Increased **asthma prevalence and related hospital visits**, deaths	Prevalence of 110,000 adults and 25,000 children. Over 7,200 visits per year. Rate of 65 ED visits per 10,000 (2000-09) DPHS 2010	Reduce asthma related ED visits from x to x in town z by 2020	Primary prevention	Participate in a program to identify at-risk youth and protect on high-ozone days	Reduce exposure to ozone via smart phone alerts and medical mgmt plan at school
				Primary prevention	Build community resilience in the area of _____	

Appendix G: Sample Template for a Climate Adaptation Plan and Evaluation Model

Provided below a template that outlines the elements of an intervention project, including baseline measures and targets to reach in the areas of community resilience or public health outcomes.

Goal 1	
Objective	
Strategic Approach STRATEGY 1: STRATEGY 2: STRATEGY 3: STRATEGY4:	

Work Plan

Objective:		
STRATEGY 1:		
Activities	Short-term Performance Targets	Intermediate Performance Targets

STRATEGY 2:		
Activities	**Short-term Performance Targets**	**Intermediate Performance Targets**
STRATEGY 3:		
Activities	**Short-term Performance Targets**	**Intermediate Performance Targets**
STRATEGY 4:		

Appendix H: Community Interventions

G-1: Community Interventions to Prevent Asthma

In 2008, approximately 11% of adults and 8% of children had asthma (NH Asthma Control Program). Behaviors such as smoking and lack of physical activity are both linked to increased incidence of asthma (Asthma Burden Report). However, there are also several environmental triggers associated with onset and exacerbation of asthma. These environmental triggers include pollen, mold, secondhand smoke, dust mites, cockroaches and other pests, pet dander, and chemical irritants (EPA Website). With increasing temperatures, changing precipitation patterns, altered growing seasons, and shifting pollen composition, climate change presents a distinct threat to those with asthma, as well as those at risk of developing asthma.

While there is no cure for asthma, it can be managed and environmental triggers can be controlled. A Healthy Homes Approach is a holistic and comprehensive prevention strategy aimed at reducing triggers. To learn more refer to the NH Healthy Homes Strategic Plan and follow New Hampshire's Health Homes "One-Touch" approach and Keep It

- Dry
- Clean
- Well ventilated
- Free of contaminants
- Pest free
- Maintained
- Safe

For more information:
Sample Community Interventions
http://www.thecommunityguide.org/asthma/multicomponent.html
New Hampshire State Asthma Plan
http://www.dhhs.state.nh.us/dphs/cdpc/asthma/documents/state-plan.pdf
Facts about Asthma
www.epa.gov/asthma.about.html
Asthma Triggers
www.epa.gov/asthma/triggers.html
Healthy Homes Community Initiative
www.epa.gov/region7/citizens/healthy_homes.htm

G-2: Community Interventions to Prevent Heat-related Illness in the Elderly

The Elderly are often considered a vulnerable population, at increased risk of disease compared to the average population. This is true in the context of rising temperatures and heat-related illness. The elderly may be at increased risk of heat-related morbidity and mortality; they are less likely to sense and respond to changes in temperature. With increasing temperatures and increased intensity of heatwaves, it is important to have a Heat Action Plan that clearly addresses how vulnerable populations, such as the elderly, will be protected. Many strategies are outlined in New Hampshire Excessive Heat Emergency Response Plan. In general, a three-tiered approach to prevention is suggested: outreach, education, and emergency planning.

Reducing risk at the individual level:

- Stay cool
- Stay hydrated
- Stay informed

Key Points to Consider (CDC: Heat and the Elderly):

- Stay in air-conditioned buildings as much as possible. Contact your local health department or locate an air-conditioned shelter in your area.
- Do not rely on a fan as your primary cooling device during an extreme heat event.
- Drink more water than usual and don't wait until you're thirsty to drink.
- Check on a friend or neighbor and have someone do the same for you.
- Don't use the stove or oven to cook—it will make you and your house hotter.
- Wear loose, lightweight, light-colored clothing.
- Take cool showers or baths to cool down.
- Check the local news for health and safety updates.
- Seek medical care immediately if you have, or someone you know has, symptoms of heat-related illness like muscle cramps, headaches, nausea or vomiting.

Reducing risk at the community level:
State and local health agencies should work together to develop a Heat Action Plan. Many communities will open cooling centers or encourage the use of public facilities with air conditioning to reduce extreme heat exposure. Some communities are exploring possible Air Conditioning Rental Programs.

For more information:
Extreme Heat and Your Health
http://www.cdc.gov/extremeheat/
Know the Early Warning Signs
http://www.cdc.gov/extremeheat/warning.html
Media ToolKit
http://www.cdc.gov/extremeheat/materials.html
NH Department of Health and Human Services' Excessive Heat Fact Sheet:
http://www.dhhs.nh.gov/tips/documents/heat.pdf

G-3: Community Interventions to Prevent Tick-Borne Disease

Across New Hampshire, Lyme Disease is the most reported Tick-borne Disease. It is transmitted via the black-legged tick (*lxodes scapularis*). Black-legged ticks have four life stages: eggs, larvae, nymphs and adults. The black-legged tick nymphs are most active in the late spring through summer months (May-August) and are the most likely to infect humans with tickborne diseases. Changing temperature and precipitation patterns are likely to impact suitable tick habitat, as well as disease transmission.

To Prevent Lyme Disease:

- Wear repellent
- Wear light colored clothing
- Check for ticks daily
- Shower soon after being outside
- Call your doctor if you get a fever or rash

For more information:
Lyme and other Tick-borne Diseases

http://www.dhhs.nh.gov/DPHS/cdcs/lyme/index.htm
Tick Bite Fact Sheet
http://www.dhhs.nh.gov/DPHS/cdcs/lyme/documents/tickbites.pdf
Lyme Disease Fact Sheet
http://www.dhhs.nh.gov/DPHS/cdcs/lyme/documents/lyme.pdf
EPA: Choosing an Insect Repellent
http://www2.epa.gov/insect-repellents

G-4: Community Interventions to improve Emergency Preparedness

Climate change is expected to increase the number and severity of extreme weather events. Extreme weather events can include ice storms, downpours, floods, droughts, heatwaves, and nor'easters. These extreme events increase the risk of injury and death. It is essential that Emergency Management Plans integrate Public Health Prevention when planning for the impacts of climate change.

Fore more information:

State Hazard Mitigation Plan
https://www.nh.gov/safety/divisions/hsem/HazardMitigation/documents/hazard-mitigation-plan.pdf
Emergency Response Plan
http://nh.stormsmart.org/before/emergency-services/emergency-response-plan/
Work to develop something like Community Assessment for Public Health Emergency Response (CASPER) Toolkit9

Appendix I: Resources and Supporting Data

Background on Weather and Climate Issues

- NH Department of Safety, Multi-Hazard Mitigation Plan and climate issues, 2014
- NH Climate Action Plan, 2009
- Center for Disease Control & Prevention Efforts to Build Resilience, 2012-2016
- NH State Health Improvement Plan (SHIP), and emergency preparedness
- UNH, USGS and DHHS Reports on Climate Vulnerabilities and Health Impacts
- White House Report on Climate and Health (June, 2014) http://www.whitehouse.gov/
- National Climate Assessment: Chapter 9-Human Health: http://nca2014.globalchange.gov/downloads

Background on Health and Climate Issues

- Center for Disease Control and Prevention Technical Assistance resources. http://www.CDC.gov/climateandhealth/technical_assistance.htm

Examples of Weather and Climate-Related Health Impacts

- Pollen-Air Pollution and Asthma/allergy
- Extreme Heat Events and Heat Injury
- Extreme Weather and Traumatic Injury
- Habitat Change and Vector borne disease (e.g. Ticks & Lyme Disease)
- Climate Change and Mental Health

Training

- Trainings on Weather, Climate and Community Resilience. http://toolkit.climate.gov/training-courses
- NACCHO Climate Change Tool Kit, 2014 www.naccho.org
- Health Officer efforts for climate planning, ASTHO Guidance, 2012 http://astho.org/

Funding Sources

- FEMA Hazard Mitigation Planning, pre-event

Tools to Assess Community Status and Measure Resilience

In order to build resilience, you need to decide what you want to change and how you can prove that you've made progress. This field of study is new, yet there are a few emerging guides and dashboards that can help you choose and track your improvements.

- Disaster Assessment and Assistance Dashboard (DAAD) for community resilience
- National Health Security Preparedness Index (NHSPI) for state-level public health preparedness
- TBD PHN Health Vulnerability Assessments - Add a tool for local level emergency preparedness (related to health issues)
- Coastal Resilience Index for flood and storm surge
- Prevention Institute THRIVE Tool for public health and safety
- US Climate Resilience Toolkit for mapping, prioritizing and acting on extreme weather events

Tools to Assess Interventions and Build Community Resilience

The following resources are helpful for understanding and developing interventions to build resilience among specific populations, workforce, and the community at large.

- Building a Resilient Workforce: Opportunities for the Department of Homeland Security: Workshop Summary 2012.
- The Center for Disease Control and Prevention Community Guide – a public health resource for evidence-based interventions
- Heat Waves and Heat Injury Interventions – New York State review
- Asthma, Allergy and Pollen Interventions
- Ticks, Lyme Disease and Vector-Borne Interventions – Connecticut guide
- Floods and Injury Prevention – research on vulnerable pops and actions
- Coastal Weather and Interventions – GOMA climate alert project
- Disasters and Mental Health Interventions – research on pre and post event actions

Projecting the Disease Burden Tools (page 16)

- WISDOM query tool for current NH disease counts, rates and deaths
- Ask Katie Bush to add any additional resources here
- UNH HealthMap query tool for projecting future disease rates
- Any local Community Health Improvement Plans (CHIPs) – may be available via Neil
- Sample table for listing health impacts in your region

Tools to help develop and implement a Climate and Health Adaptation Plan in your region (Page 19)

- Vermont report on Climate Change Health Effects Adaptation at the state level
- Massachusetts report on Climate Change Adaptation for human health and welfare
- Oregon Climate & Health Adaptation Planning for County Health Agencies
- California Climate Action for Health for integrating health into other plans
- NH Climate and Health State-Level Strategic Plan of Action
- NH DES Climate Adaptation Toolkit for NH Communities
- Keene NH Adapting to Climate Change: Planning a Climate Resilient Community
- Georgetown Climate Center Adaptation Clearinghouse for energy policies
- Sample template for the elements of a Climate & Health Adaptation Plan

References:

Fran H. Norris, Susan P. Stevens, Betty Pfefferbaum, Karen F. Wyche, Rose L. Pfefferbaum. Community Resilience as a Metaphor, Theory, Set of Capacities, and Strategy for Disaster Readiness. American Journal of Community Psychology March 2008, Volume 41, Issue 1-2, pp 127-150 Date: 22 Dec 2007 http://link.springer.com/article/10.1007/s10464-007-9156-6

Gino D. Marinucci 1, George Luber 1, Christopher K. Uejio 1,2, Shubhayu Saha, and Jeremy J. Hess, Building Resilience against Climate Effects—A Novel Framework to Facilitate Climate Readiness in Public Health Agencies. Int. J. Environ. Res. Public Health 2014, *11*, 6433-6458; doi:10.3390/ijerph110606433 http://www.mdpi.com/1660-4601/11/6/6433

Grambsch, A. and B. Menne, eds. *Chapter 11: Adaptation and Adaptive Capacity in the Public Health Context*. Climate Change and Human Health: Risks and Responses, ed. A.J. McMichael, et al. 2003, WHO: Geneva. http://wwwlive.who.int/entity/globalchange/publications/climatechangechap11.pdf

Note: pages 48-51 are not missing. This is a page numbering error.